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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup> :</b> <b>A47K 10/16, D21H 27/00</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 98/48684</b> <b>(43) International Publication Date:</b> 5 November 1998 (05.11.98)
<b>(21) International Application Number:</b> PCT/US98/08529 <b>(22) International Filing Date:</b> 30 April 1998 (30.04.98) <b>(30) Priority Data:</b> 08/846,771                      30 April 1997 (30.04.97)                      US <b>(71) Applicant:</b> KIMBERLY-CLARK WORLDWIDE, INC. [US/US]; 401 North Lake Street, Neenah, WI 54957-0349 (US). <b>(72) Inventors:</b> MAHAFFEY, Cleary, E.; 4970 Chatsworth Lane, Suwanee, GA 30174 (US). BREYER, Walter, H.; 1275 Poplar Grove Lane, Cumming, GA 30131 (US). CHIU, Taiwoo; 1520 Shade Tree Way, Alpharetta, GA 30201 (US). <b>(74) Agents:</b> JONES, Neil, C. et al.; Dority & Manning, P.A., P.O. Box 1449, Greenville, SC 29602-1449 (US).		<b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW); Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM); European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE); OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> FLUSHABLE CELLULOSIC PRODUCTS AND PROCESSES AND SYSTEMS FOR FLUSHING SUCH PRODUCTS		
<b>(57) Abstract</b> <p>The present invention provides a cellulosic article, such as a paper hand towel or pre-moistened wipe or towelette or wiper, which will become flushable in a toilet system upon contact with an additive supplied to the toilet system. The additive may be a chemical, an electrical charge, or ultrasonic vibration. The flushing system may utilize a drip mechanism or a chemical block trigger to supply the addition of a trigger additive to the toilet system or may use manual addition of the additive.</p>		

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## FLUSHABLE CELLULOSIC PRODUCTS AND PROCESSES AND SYSTEMS FOR FLUSHING SUCH PRODUCTS

### Field of the Invention

The present invention is directed to the field of cellulosic  
5 articles, such as hand towels, pre-moistened wipes and towelettes,  
wipers, and the like, that are disposable in toilet and sewer systems.

### Background of the Invention

Cellulosic articles used for personal care, such as toilet  
tissues, hand towels, pre-moistened wipes and towelettes, and other  
10 wipers, are often disposed of by users in toilet and sewer systems.  
Most toilet tissues are made for being discarded in toilets because  
they are composed of cellulosic materials having only a minimal wet  
strength. Toilet and bathroom tissues easily disintegrate and  
disperse upon being agitated with the water contained in conventional  
15 toilet and sewage systems. Such tissues are not designed, however,  
for applications where substantial liquids will be encountered during  
use.

Hand towels, wipes and towelettes, and other wipers are  
generally much stronger than toilet tissues. They are formed from  
20 cellulosic materials in a manner that provides sufficient strength when  
wet to be used for various uses such as wiping one's hands, wiping  
the bottoms of babies, absorbing liquid spills, cleaning surfaces, and  
the like. Due to their lack of strength, toilet tissues are generally  
unsuitable for such uses. Because of their additional strength,  
25 however, paper towels, wipes and towelettes (both dry and pre-  
moistened), and wipers are sometimes a problem when flushed  
through a conventional toilet system. Often, such products will  
remain intact even when subjected to the agitation action of the toilet  
and sewer system. Even products having "temporary" wet strengths  
30 often require 20 or more minutes to reach a flushable wet strength.  
Accumulation of such products results in clogged drains and toilets.

As used herein, "flushable" refers to the capability of a product to be flushed in a conventional toilet and introduced into a municipal sewage or residential septic system without causing an obstruction or blockage in the toilet or sewage system. Flushable products would include those whose binding materials disassociate so that the cellulosic web forming the paper product is dispersed, as well as products whose dimensions become non-restrictive to transport throughout the plumbing system without clogging. As used herein, "toilet" refers to conventional toilets as well as all other plumbing fixtures which are connected to a sewage system such as urinals, sinks, etc.

Ideally, paper towels and the like would be flushable in conventional toilets as are most toilet tissues. Unlike toilet tissue, however, such flushable paper products must have sufficient strength for their intended uses, which generally involve the absorbing of liquids and the wiping of a body part or other surface.

Previously, many efforts to design flushable products have been directed to developing flushable articles such as infant diapers, child care products such as training pants, adult care products such as adult diapers and adult incontinence pads, feminine pads, wound dressings, household wipes, fabrics, tapes, yarns, etc., that will disperse on contact with ordinary tap water. U.S. Patent No. 5,509,913 discloses such articles which are flushable in ordinary toilet and sewer system waters at temperatures below approximately 23°C, but insoluble in the presence of body fluids having temperatures above approximately 25°C.

Attempts have also been made to develop towelettes that are readily disposable and water dispersible. For example, U.S. Patent No. 5,252,332 discloses a pre-moistened towelette comprising a polyvinyl alcohol binder which is wet-packaged in a solution containing borate ions and bicarbonate ions. The towelette retains a

certain wet strength while packaged and during at least a part of use, but disintegrates in water. U.S. Patent No. 5,085,736 discloses the use of wet strength resins in paper products which only temporarily maintain a suitable wet strength for the product (so called "temporary wet strength agents"). U.S. Patent No. 4,242,408 discloses a non-woven web having enhanced wet strength and easy disposability in an environment with a high pH. The invention described therein uses a pH-sensitive binder in forming the web which will disperse at a high pH.

Some fabrics and films have been developed which exhibit water-barrier properties and which are dispersible in or lubricated by certain solutions. For example, U.S. Patent No. 4,035,540 discloses a polymeric composition having a silane crosslinked interpolymer that imparts water barrier properties to films produced therefrom. The films are solubilizable in aqueous alkaline or acidic solutions with pHs of about 12 or higher or about 3 or lower. U.S. Patent No. 4,868,024 discloses a sheet material for making a toilet-disposable article, such as a bag for body waste products, that is unaffected by contact with water of a neutral pH, but which is degraded on contact with an alkali added to the toilet bowl. Like the fabric disclosed in U.S. Patent No. 4,035,540, this material is liquid resistant and is, for example, usable in forming water-impenetratable articles such as bedpan liners and disposable bags. U.S. Patent No. 5,417,677 discloses a flushable ostomy pouch composed of pH-sensitive material capable of dissolving when exposed to an aqueous fluid in a toilet having a pH substantially above or below a neutral pH level.

U.S. Patent No. 4,930,942 is directed to the formation of articles such as ostomy pouches, wound dressings, bandages, diapers, etc., that can be flushed by wrapping or enclosing the article within a material that rapidly becomes slimy or exudes a slimy material on contact with the water in a toilet bowl or by adding such

materials directly to the toilet bowl. The articles do not appear to disintegrate, but instead are lubricated or softened to ensure passage of the article through the plumbing system.

5 Although pH-controlled, toilet-dispersible products are known, many of such products are water-impermeable articles, unlike the water absorbent products of the present invention. Most of the toilet-dispersible paper products similar to the present invention are tissues which are dispersible merely by being agitated by the water in a toilet/sewer system.

10 Summary of the Invention

It is an object of the present invention to provide an article such as a hand towel, a pre-moistened wipe or towelette, or a wiper, that is flushable in a conventional toilet system when contacted by an external additive.

15           Another object of the present invention is to provide a flushing system that allows for a paper product to be flushed in a conventional toilet system without the need for human intervention.

Another object of the present invention is to provide a flushing system that allows for a paper product to be flushed in a conventional toilet system with the human addition of an external additive.

It is a further object of the present invention to provide a process for flushing a paper product by adding an additive to a conventional toilet system which will allow the paper product to sufficiently disperse so that it becomes flushable.

25                    These and other objects are achieved by providing a paper  
article that is capable of sufficiently disintegrating in a conventional  
toilet system when an additive is supplied to the system. In addition,  
these and other objects are achieved by providing a method for  
flushing a paper product in a conventional toilet system by adding an  
30                    external additive to the system. Finally, these and other objects are  
achieved by providing a flushing system wherein an additive is

supplied to a conventional toilet system to disperse a paper product when contacted with the external additive.

5           The external additive for triggering the disintegration of the paper product may be, for example, a chemical agent that adjusts the pH of the toilet system, an enzyme that attacks a starch, or some other binding agent in the paper product; a salt that "unzips" a polymer binder used in the paper product; or a halogen-containing composition that attacks a polyamide-epichlorohydrin resin used in the paper product. The external additive may also include ultrasonic  
10       vibrations or electric currents that assist in disintegrating the paper product once in the toilet system.

          An advantage of the present invention is that products made from cellulosic webs, such as towels and towelettes, which are typically absorbent if dry or moisture-providing if pre-moistened, can  
15       be provided with sufficient wet strength to serve their wiping purposes, while still being flushable to prevent clogging of the toilet system when discarded. Another advantage of the present invention exists in the ability for one manufacturer to provide a specific product to work with a specific additive system. For example, the dispersible  
20       paper product could be made additive-specific so that the particular chemical additive or additive system sold by the manufacturer of the paper product would be the only means of sufficiently breaking down that manufacturer's paper product. This would enable bathroom owners to be assured that the paper products they purchase will be  
25       effectively dispersed if they also purchase the specifically matched additive system. Use of the present system in one case avoids the need for human intervention to unclog the toilet system or plumbing if an external additive-dispersible towel is disposed of in the toilet, while another embodiment allows for the manual addition of the triggering  
30       additive.

          Other objects, features and aspects of the present invention



are discussed in greater detail below.

#### Brief Description of the Drawing

A full and enabling disclosure of the present invention, including the best mode thereof, to one of ordinary skill in the art is set forth more particularly in the remainder of the specification, including reference to the accompanying figure, in which:

Figure 1 is a plan view of a toilet having a drip mechanism for supplying the claimed external additive to the toilet system.

Repeat use of reference characters in the present specification and drawing is intended to represent the same or analogous features or elements of the invention.

#### Detailed Description of Preferred Embodiment

It is to be understood by one of ordinary skill in the art that the present discussion is a description of exemplary embodiments only, and is not intended as limiting the broader aspects of the present invention, which broader aspects are embodied in the exemplary construction.

Generally speaking, the present invention is directed to a paper article having an adequate strength when wet for its intended uses but which is capable of sufficiently disintegrating into a flushable article in a conventional toilet system when an additive is supplied to the system. In addition, the invention includes a method for flushing a paper product in a conventional toilet system by adding the external additive to the toilet system and further includes the flushing system itself wherein an additive is supplied to a conventional toilet system to disperse a paper product.

For purposes of this specification, the term "external additive" is meant to include external processes or devices such as ultrasonic vibration emitters and electric current discharge devices as well as products that are added to the toilet bowl water such as chemicals. If the external additive is a product to be added to the toilet system, the

additive may be, for example, a chemical agent that adjusts the pH of the toilet system, an enzyme that attacks a starch or some other binding agent in the paper product; a salt that "unzips" a polymer binder used in making the paper product; or a halogen-containing composition that attacks a polyamide-epichlorohydrin resin used in the paper product. If the external additive is an external process or device, the additive may be the use of ultrasonic vibrations or electric currents to disperse the paper product once in the toilet system.

More specifically, the present invention utilizes the external additive to increase the rate of degradation of the wet strength of the tissue or towel disposed of in the toilet. Unlike many of the known temporary wet strength agents, the present invention is designed to begin the disintegration process upon contact with the external additive and to quickly result in a flushable paper product.

Typically, the flushable products of the present invention can be a non-woven cellulosic web composed of from 0% to 100% virgin cellulosic fibers, or 0% to 100% recycled fiber, with the remainder of the web being composed of from 0% to 30% non-cellulosic fibers which may be obtained from a variety of sources. Typical cellulosic webs useful in the present invention are composed of one or more plies that have a total basis weight of from about 20 to about 100 grams per square meter. Typically, the machine direction wet tensile strength of the web will be no less than 100 grams per 3 inch-wide sample and the machine direction wet tensile strength to machine direction dry tensile strength ratio will be no less than about 10%.

The cellulosic webs for making paper products according to the present invention may be made by several processes known to those having ordinary skill in the art. Among exemplary processes are light weight dry creping; heavy weight dry creping; light weight wet creping; heavy weight wet creping; uncreped through air drying; creped through air drying, single re-creping, double re-creping, air lay

forming, wet lay forming, carded web forming, and coforming. Many post treatments, such as embossing, laminating, microcreping, or perembossing may also be performed on the webs in order to achieve desired properties.

5           Various of these known paper product-making techniques are disclosed in the following patents which are all incorporated herein by reference thereto: U.S. Patent No. 4,883,564 (single recreping); U.S. Patent No. 3,879,257 (double recreping); and U.S. Patent No. 5,048,589 (uncreped through air drying).

10           The key to the present invention is the matching of a specific external additive to a paper product so that dispersion of the paper product in a toilet system is triggered upon contact with the specific additive to result in a flushable product.

15           One particular series of embodiments of the present invention utilizes a chemical additive to trigger the dispersion of the product. In one embodiment, an alkalinity control agent is used. The alkalinity control agent can be either an acidic or a basic composition which alters the pH of the toilet bowl water (or sewer plumbing system water) when added thereto. Such compositions include any of the  
20           alkalis, such as lithium, sodium and potassium hydroxides, sodium carbonate solutions, ammonia solutions, calcium or barium hydroxides, as well as any of the acids such as sulfuric, hydrochloric, sodium acid sulfate, potassium acid sulfate, and the like. These control agents could include buffers. The present invention is not to  
25           be limited by the particular basic or acidic composition utilized as the alkalinity control agent in this embodiment.

30           The paper product is designed so that it will have the desired wet strength at a relatively neutral pH but will disperse and achieve flushability when subjected to the altered alkalinity of the toilet system water. Obviously, the range of alkalinity adjustment should be maintained within safe levels to prevent harm to users of the toilet.

Thus, a close-to-neutral pH range is preferred.

More specifically, the binding agents used in producing such towel products will generally be subject to breakdown at either low or high alkalinity. When subjected to the toilet bowl water with the modified alkalinity, the binding agents will disfunction and cause the cellulosic webs to disperse and disintegrate.

In a further embodiment, an organic binder, such as a starch or a modified starch, is used to impart wet strength to the cellulosic web. A chemical additive, such as an enzyme, may then be used as the agent to cause the binder to disfunction and the paper product to disperse. Moreover, in another embodiment, a polymeric binder may be used in forming the paper product and a corresponding salt that disassociates or "unzips" the polymer may be used to trigger dispersion.

A binder that is sensitive to certain compositions may also be used. For example, a polyamide-epichlorohydrin resin such as Kymene® (a product sold by Hercules, Inc.), may be used to form the product and a halogen-containing additive, such as hypochlorite, may be used as the triggering external additive. Surfactants that change the toilet bowl conditions sufficiently to allow dispersion of the particular paper products utilized may also be used as the external additive in this system. Additionally, in certain instances, products may be utilized which are dispersed by contact with cleaning solutions currently being provided to the toilet system.

Such exemplary chemical additives can be supplied to the toilet bowl or plumbing system in various ways. For example, the chemical may be supplied as part of an existing drip system attached to the toilet for supplying cleaning solutions, odor suppressing solutions, or other refresher products to the toilet bowl. Such drip systems are well known in the industry and are often set to provide solutions to the toilet bowl at periodically timed intervals or in

connection with the flushing of the toilet or to provide a continuous minimum flow of solution to the toilet. In one exemplary flushing system shown in Figure 1, a toilet 10 is arranged with a tube 20 connected to additive storage container 50 and directed to emit the external additive directly into toilet bowl 30. Tube 20 can be made of any of the well-known constructions for such drip mechanisms, including flexible plastic materials. The periodic discharge of the external additive (as well as other cleaners, odor suppression agents, and the like) into the toilet bowl is managed in the embodiment shown by a timing mechanism 40. Alternatively, a photosensitive detector mechanism could be used to regulate the periodic discharge of the external additive when toilet users are present. Again, such mechanisms are well known in the art.

Other various embodiments well known in the art for delivering such chemical additives include various automatic trigger delivery systems. Among such automatic trigger delivery systems currently known are water supply induction, float mechanism addition, and chemical additive injection systems. Each of these systems is well known in the art and are all part of the present invention.

During use, a measured amount of the external additive is discharged into toilet bowl 30. In this manner, sufficient amounts of the external additive will remain in the toilet bowl for contacting any paper products discarded therein.

Alternatively, the chemical may be supplied through a separate drip system to the toilet, the plumbing, or the sewage system. In addition, the chemical additives could be supplied as separately packaged additives so that they could be added manually before or during each flush by the toilet users. Such separate packaging could be pouches holding solid forms of the additive, a toilet tank tablet comprising the additives, or syringes, bottles, sachets, or other containers holding liquid forms of the additive. The separately

packaged additives could also be added manually to the toilet/sewer system after a clog has already developed so that it could be alleviated and normal passage flow returned.

5 In another series of embodiments, external forces are substituted for the chemical additives. An example of such an external force is the use ultrasonic vibrations acting on the water in the toilet system. Paper product binders in this embodiment are specifically designed to disintegrate when subjected to such vibrations.

10 Alternatively, a wet strength agent may be used in forming the paper product which disfunctions after being subjected to a mild ionization so that a slight electric current applied to the toilet/sewer system causes the paper product to become flushable.

15 Although preferred embodiments of the invention have been described using specific terms, devices, and methods, such description is for illustrative purposes only. The words used are words of description rather than of limitation. It is to be understood that changes and variations may be made by those of ordinary skill in the art without departing from the spirit or the scope of the present invention, which is set forth in the following claims. In addition, it should be understood that aspects of the various embodiments may be interchanged both in whole or in part.

20

**What is claimed is:**

1. A cellulosic article having sufficient strength characteristics when wet to be used as a wiping product, said product being flushable in a toilet system when contacted with an external additive supplied to said toilet system.
2. The cellulosic article of claim 1, wherein said cellulosic article is a paper product.
3. The cellulosic article of claim 1, wherein said wiping product is a paper towel.
4. The article of claim 1, wherein said wiping product is a dry hand towel having a total basis weight of at least about 20 grams per square meter.
5. The article of claim 1, wherein said wiping product is a pre-moistened towelette.
6. The article of claim 1, wherein said external additive is a chemical.
7. The article of claim 1, wherein said external additive is ultrasonic vibration.
8. The article of claim 1, wherein said external additive is an electric current.
9. The article of claim 1, wherein said external additive comprises an alkalinity modifier and said article is subject to disintegration in a modified alkalinity range.
10. The article of claim 1, wherein said external additive comprises an enzyme and said article is subject to disintegration when in contact with an enzyme.
11. The article of claim 1, wherein said external additive comprises a salt and said article is subject to disintegration when in contact with a salt.
12. The article of claim 1, wherein said external additive comprises a halogen composition and said article is subject to

disintegration when attacked by a halogen composition.

13. The article of claim 1, wherein the total basis weight of the article is less than about 100 grams per square meter.

14. The article of claim 1, wherein the total basis weight of the article is between about 20 grams per square meter and about 100 grams per square meter.

15. The article of claim 1, wherein the machine direction wet tensile strength of the article is at least about 100 grams per 3-inch wide sample of product.

16. The article of claim 1, wherein the machine direction wet tensile strength to machine direction dry tensile strength ratio is at least about 10%.

17. The article of claim 1, wherein the total basis weight of the article is between about 20 grams per square meter and about 100 grams per square meter, the machine direction wet tensile strength of the article is at least about 100 grams per 3-inch wide sample of the article, and the machine direction wet tensile strength to machine direction dry tensile strength ratio is at least about 10%.

18. A method for disintegrating a cellulosic article to a sufficient point to allow flushability of said article in a toilet system by adding an external additive to said toilet system.

19. The method of claim 18, wherein said external additive is added to said toilet system by a drip mechanism.

20. The method of claim 18, wherein said external additive is added to said toilet system as a toilet bowl cleaning solution.

21. The method of claim 18, wherein said external additive is added manually to said toilet system prior to or during flushing of said article.

22. The method of claim 18, wherein said external additive is a chemical.



23. The method of claim 18, wherein said external additive is ultrasonic vibration.

24. The method of claim 18, wherein said external additive is an electric current.

25. The method of claim 18, wherein said external additive is added to said toilet system by water supply induction.

26. The method of claim 18, wherein said external additive is added to said toilet system by float mechanism addition.

27. The method of claim 18, wherein said external additive is added to said toilet system through an injection system.

28. An article flushing system for allowing said article to be flushed in a conventional toilet system, said flushing system comprising:

- a) a cellulosic article capable of exhibiting flushability when contacted with an external additive; and
- b) an external additive to be added to said toilet system during flushing of said cellulosic article.

29. The article flushing system of claim 28, wherein said external additive comprises an alkalinity agent and said cellulosic article is subject to disintegration within a modified alkalinity range.

30. The article flushing system of claim 28, further comprising a drip mechanism which periodically supplies said external additive to said toilet system.

31. The article flushing system of claim 28, further comprising a float mechanism for adding said external additive.

32. The article flushing system of claim 28, further comprising a water supply induction mechanism for supplying said external additive to said toilet system.

33. The article flushing system of claim 28, further comprising an injection system for supply said external additive to said toilet system.

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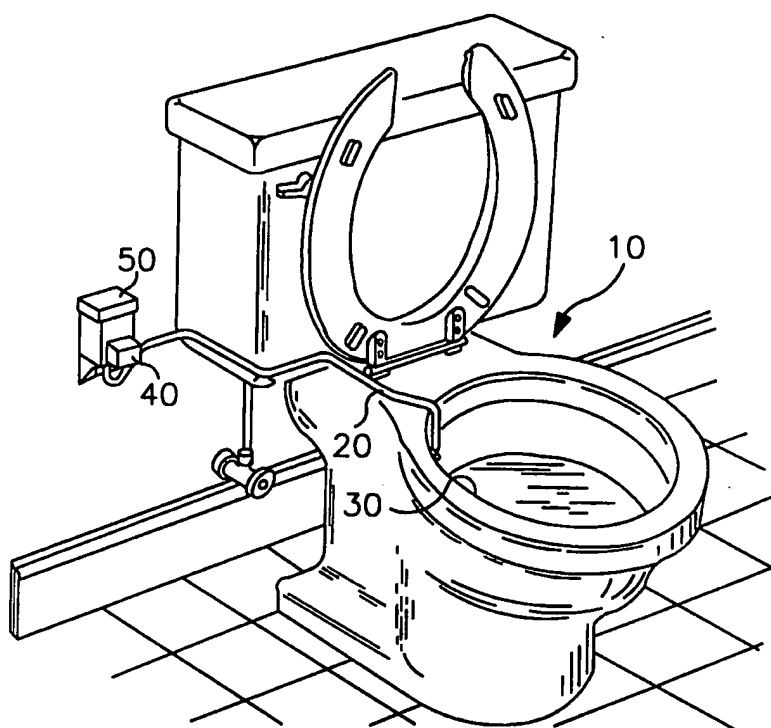


FIG. 1

# INTERNATIONAL SEARCH REPORT

national Application No

PCT/US 98/08529

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 6 A47K10/16 D21H27/00		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC 6 A47K D21H		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used)		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 014, no. 275 (C-0728), 14 June 1990 & JP 02 082925 A (KINPOU SEISHI KK), 23 March 1990 see abstract ---	1, 18, 28
A	US 5 509 913 A (YEO RICHARD S C) 23 April 1996 cited in the application ---	
A	US 5 252 332 A (GOLDSTEIN JOEL E) 12 October 1993 cited in the application ---	
A	US 4 242 408 A (EVANI SYAMALARAO ET AL) 30 December 1980 cited in the application ---	
-/--		
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Date of the actual completion of the international search  11 August 1998		Date of mailing of the international search report  18/08/1998
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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 868 024 A (CROSS DAVID E ET AL) 19 September 1989 cited in the application ---	
A	US 4 930 942 A (KEYES DENIS E ET AL) 5 June 1990 cited in the application -----	

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